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S/139/59/000/06/004/034
E091/E135

Influence of Dispersion of $CuAl_2$ Inclusions on the Temperature-Rate Dependence of Mechanical Properties of Duralumin

to be investigated, cylindrical specimens (7 x 11 mm) were made for compression tests, which were subsequently heat treated in such a way as to obtain $CuAl_2$ inclusions of various sizes. In the first part of the work, the behaviour of duralumin in compression at the following temperatures was studied: -80, 20, 90, 155, 230, 300 and 390 °C. The rate of deformation was 0.17 mm/minute. A special muffle, which has been described by Zagrebennikova, Ilyushchenkov and Sukharina (Ref 5) was used for low temperature tests (at -80 °C). In Fig 1a the path of flow curves is shown for duralumin through the matrix of which extremely fine particles of $CuAl_2$ are dispersed (dispersion I, r = 0.8 μ). Fig 1b shows the results for duralumin, in which r = 1.1 μ (dispersion II). Fig 1c corresponds to a material with a particle dispersion III (r = 1.5 μ). From Fig 2 the path of flow curves for material having the coarsest $CuAl_2$ inclusions (dispersion IV, r = 2.2 μ) can be seen. Fig 3 shows the dependence of the stress σ_{30}, corresponding to a deformation of

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Influence of Dispersion of $CuAl_2$ Inclusions on the Temperature-Rate Dependence of Mechanical Properties of Duralumin

30%, on deformation temperature. Curves 1, 2, 3 and 4 are given for material exhibiting the respective dispersions. Fig 4 shows the dependence of σ_{30} on the logarithm of the mean distance between $CuAl_2$ particles. Figs 5, 6 and 7 show flow curves for quenched duralumin with dispersions I, II, III and IV of $CuAl_2$ particles, at various temperatures of deformation (T_{def}). In Fig 5 T_{def} = -80 °C; in Fig 6 T_{def} = 20 °C; and in Fig 7 T_{def} = 155 °C. In all three figures, the black circles correspond to the standard rate of deformation (0.17 mm per minute) and the white circles to different rates of deformation. The authors arrive at the following conclusions: 1) The size of the hard inclusions exerts a considerable influence on the resistance of the alloy to deformation. Alloys with the greatest dispersion of hard inclusions within the whole range of temperatures and rates of deformation investigated have the highest mechanical properties. The greater resistance to compression exhibited by duralumin with the coarsest $CuAl_2$

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inclusions, as compared with that of material of dispersion III, in the temperature range 90-155 °C, is due to additional ageing of this alloy during deformation. 2) The dependence of stress σ_{30} on the logarithm of the mean distance between $CuAl_2$ particles is linear in nature in the whole temperature range investigated, except for the range 90-155 °C, in which the deviation is also due to additional ageing of the alloy during deformation. There are 7 figures and 7 references, of which 2 are English and 5 are Soviet.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Physico-Technicological Institute, Tomsk State University imeni V.V. Kuybyshev)

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SUBMITTED: April 11, 1959

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SAVITSKIY, K. V.

PHASE I BOOK EXPLOITATION SOV/4502

Akademiya nauk SSSR. Nauchnyy sovet po probleme zharoprochnykh splavov

Issledovaniya po zharoprochnym splavam, tom 6 (Investigations of Heat-Resistant Alloys, Vol. 6) Moscow, 1960. 319 p. Errata slip inserted. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A. A. Baykova. Nauchnyy sovet po probleme zharoprochnykh splavov.

Editorial Board: I. P. Bardin (Deceased) Academician, G. V. Kurdyumov, N. V. Ageyev, Corresponding Member, Academy of Sciences USSR (Resp. Ed.), I. A. Oding, I. M. Pavlov, and I. F. Zudin, Candidate of Technical Sciences; Ed. of Publishing House: V. A. Klimov; Tech. Ed.: S. G. Tikhomirova.

PURPOSE: This book is intended for research workers in the field of physics of metals and for metallurgists, particularly those working on heat-resistant alloys.

COVERAGE: This collection of 45 articles deals with various problems in the production of heat-resistant alloys. Special attention is paid to the mechanisms of deformation of such metals as aluminum, copper, iron, and nickel. Various defects and failures of metals are analyzed, and means for increasing the heat resistance and plasticity are described. Among the special problems discussed are: electrolytic conductivity of iron-aluminum alloys in the solid state; the mobility of atoms in nickel-iron alloys, depending upon defects of their crystalline structure; the kinetics of change in isolated pores; the irreversible thermal transformation of solid bodies, etc. No personalities are mentioned. References follow each article.

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SAVITSKIY, K.V.

PHASE I BOOK EXPLOITATION SOV/5053

Vsesoyuznaya konferentsiya po treniyu i iznosu v mashinakh. 3d, 1958.

Iznos i iznosostoykost'. Antifriktsionnyye materialy (Wear and Wear Resistance. Antifriction Materials) Moscow, Izd-vo AN SSSR, 1960. 273 p. Errata slip inserted. 3,500 copies printed. (Series: Its: Trudy, v. 1)

Sponsoring Agency: Akademiya nauk SSSR. Institut mashinovedeniya. Resp. Ed.: M. M. Khrushchov, Professor; Eds. of Publishing House: M. Ya. Klebanov, and S. L. Orpik; Tech. Ed.: T. V. Polyakova.

PURPOSE: This collection of articles is intended for practicing engineers and research scientists.

COVERAGE: The collection, published by the Institut mashinovedeniya, AN SSSR (Institute of Science of Machines, Academy of Sciences USSR) contains papers presented at the III Vsesoyuznaya Konferentsiya po treniyu i iznosu v mashinakh (Third All-Union Conference on Friction and Wear in Machines) which was held April 9-15, 1958. Problems discussed were in 5 main areas: 1) Hydrodynamic Theory of Lubrication and Friction Bearings (Chairmen: Ye. M. Gut'yar, Doctor of Technical Sciences, and A. K. D'yachkov, Doctor of Technical Sciences); 2) Lubrication and Lubricant Materials (Chairman: G. V. Vinogradov, Doctor of Chemical Sciences); 3) Dry and Boundary Friction (Chairmen: B. V. Deryagin, Corresponding Member of the Academy of Sciences USSR, and I. V. Kragel'skiy, Doctor of Technical Sciences); 4) Wear and Wear Resistance (Chairman: M. M. Krushchov, Doctor of Technical Sciences); and 5) Friction and Antifriction Materials (Chairmen: I. V. Kragel'skiy, Doctor of Technical Sciences, and M. M. Krushchov, Doctor of Technical Sciences). Chairman of the general assembly (on the first and last day of the conference) was Academician A. A. Blagonravov. L. Yu. Pruzhanskiy, Candidate of Technical Sciences, was scientific secretary. The transactions of the conference were published in 3 volumes, of which the present volume is the first. This volume contains articles concerning the wear and wear resistance of antifriction materials. Among the topics covered are: modern developments in the theory and experimental science of wear resistance of materials, specific data on the wear resistance of various combinations of materials, methods for increasing the wear resistance of certain materials, the effects of friction and wear on the structure of materials, the mechanism of the seizing of metals, the effect of various types of lubricating materials on seizing, abrasive wear of a wide variety of materials and components under many different conditions, modern developments in antifriction materials, and the effects of finish machining on wear resistance. Many personalities are mentioned in the text. References accompany most of the articles.

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PHASE I BOOK EXPLOITATION SOV/5053

Vsesoyuznaya konferentsiya po treniyu i iznosu v mashinakh. 3d, 1958.

Iznos i iznosostoykost'. Antifriktsionnyye materialy (Wear and Wear Resistance. Antifriction Materials) Moscow, Izd-vo AN SSSR, 1960. 273 p. Errata slip inserted. 3,500 copies printed. (Series: Its: Trudy, v. 1)

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S/139/60/000/01/029/041
E073/E335

18,8100

AUTHORS: Savitskiy, K.V., Zagrebennikova, M.P. and Rebenok, V.F.

TITLE: Influence of the Degree of Dispersion of $CuAl_2$ Inclusions on the Behaviour of Duralumin Under Conditions of Deformation with a Variable Test Temperature

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 1, pp 168 - 170 (USSR)

ABSTRACT: In an earlier paper (Ref 2) the authors studied the influence of the degree of dispersion of $CuAl_2$ inclusions on the temperature and the speed dependence of the mechanical properties of duralumin under conditions of simple compression; they found that the dimension and the distribution of particles of the second phase show a considerable influence on the slip process. The present paper is devoted to the study of the behaviour of duralumin D1 with various degrees of dispersion of the hard $CuAl_2$ particles under conditions of variable test temperatures during deformation. It was anticipated that under such complicated conditions of deformation the advantages of a given structure should manifest themselves

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Influence of the Degree of Dispersion of $CuAl_2$ Inclusions on the Behaviour of Duralumin Under Conditions of Deformation with a Variable Test Temperature

most clearly. Also such investigations may yield additional information for verifying the correctness of the mechanical equalisation of the state for alloys, namely, they may indicate the role of secondary processes during deformation of the alloy under such conditions. Such investigations are of practical interest from the point of view of aviation, since duralumin aircraft components are required to work under a variety of conditions, including considerable temperature variations. The aim of the work described in this paper was to investigate the behaviour of duralumin in various states, differing from each other in the degree of dispersion of the $CuAl_2$ particles, under conditions of changing temperature. The degrees of dispersion were as follows: I = average particle distance $r = 0.8\ \mu$; II = average distance between the particles $r = 1.1\ \mu$; III = average distance between the particles $r = 1.5\ \mu$ and IV = average distance between the particles $r = 2.2\ \mu$. In earlier work (Ref 2)

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it was found that the most metastable material is duralumin with IV-th degree dispersion, whilst the metastability of the material with degrees I, II and III of dispersion is slight and approximately the same. The authors investigated the effects of the following temperature variations during compression:
1) - 80 → 20 → 155 °C; 2) 20 → - 80 → 155 °C;
3) 155 → 20 → - 80 °C; 4) 20 → 155 → - 80 °C.
The changes in the test temperature were achieved as follows: at the temperature T_1 the specimen was compressed by 10%, relieved of the load and placed into a second sleeve which had the required temperature T_2 and again compressed a further 10%; the last reduction step of the specimens was effected in a third sleeve with the temperature T_3 in the working space; thereby the deformation speed was 0.17 mm/min. For obtaining each of the curves, 5 specimens were deformed under the conditions of a given temperature change; the maximum deviation from the average value of σ was 1-2% or 0.3 - 0.6 kg/mm^2. The

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obtained results indicate that in many cases for duralumin, which in the θ-solid solution has hard inclusions of various sizes, definite relations can be observed in the characteristics of the flow curves, which are similar to those obtained by other authors in tensile tests with pure metals. Figure 1 is a plot of the flow curves of duralumin of the degree of dispersion II during compression under conditions of the temperature variations: - 80 → 20 → 155 °C. The full dots indicate values measured in the case of continuous compression; the circles indicate the values obtained in the case of compression under conditions of changing temperature. Figure 2 shows similar curves for duralumin with the degree of dispersion IV in the case of compression with a temperature changing from 155 → 20 → -80°C. The results show that the degree of dispersion of the solid inclusions has a definite influence on the characteristics of the flow curves in tests under changing

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temperature conditions. Additional ageing of the alloy during deformation at elevated temperature (155 °C) can lead to a deviation from the regular shape of the flow curves established by a number of authors during testing of pure metals.
There are 2 figures and 5 references, 1 of which is international, 1 English and 3 Soviet.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva
(Siberian Physico-technical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: August 3, 1959

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S/139/60/000/01/038/041
E073/E335

AUTHORS: Savitskiy, K.V. and Sukharina, N.N.

TITLE: Investigation of the Wear-resistance of Steel Heat-treated to Obtain Granular Cementite

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 1, pp 228 - 233 (USSR)

ABSTRACT: The aim of the work described in this paper was to investigate the dependence of the wear-resistance of steel on the degree of dispersion of globular cementite particles. The investigations were carried out in the carbon steels 45 (0.40% C) and U8 (0.83% C) which were heat-treated to obtain granular cementite. The steel U8 was quenched from 840 °C and then tempered at 680 °C. By varying the soaking time at this temperature, structures were obtained with various dimensions of the cementite inclusions. One batch was tempered for 15 min, resulting in a relatively finely dispersed structure, the second batch was tempered for 3 hours, the third batch was tempered for 6 hours and again for 2 hours at 600 °C, and the last batch was tempered for 48 hours at 680 °C. The steel 45 specimens were quenched from 820-840 °C and

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and annealed at 680 °C for durations of 2, 6 and 24 hours. Thus, four batches of specimens of U8 steel and three batches of the steel 45 with differing dispersions of the carbide particles were obtained. The wear-resistance tests were carried out under conditions of dry friction. The lower specimen, roller of 50 mm dia, was produced from steel ShKh15 with a hardness of R_c = 61-62 after heat treatment, having a ground rubbing surface. The tested specimen was placed on the immobile axis of the top shaft of the machine; the contact area was 0.8 cm^2. The specimen was loaded with 30 kg. After manufacture the specimens were run in for 20-30 min and only then were they heat-treated. During the experiments the moment of friction as well as the friction work were measured. The wear was evaluated from the loss of weight, as determined by analytical scales with an accuracy of 0.1 mg. After the tests the microhardness of the rubbing

Investigation of the Wear-resistance of Steel Heat-treated to Obtain Granular Cementite

surface was measured and the surface layers of the worn surfaces were subjected to metallographic investigations, using oblique cuts made at an angle of 3-4°. The results are entered in plots, Figures 1-3. The following conclusions are arrived at. Steels with the same carbon content but with differing dimensions of the cementite inclusions show differing wear resistance. It was found that an accumulation of the carbide phase takes place in the surface layers of rubbing surfaces during the process of wear of steel with a structure of a granular pearlite and this accumulation is the more intensive the more plastic the material. The deformation of the surface layers, which is brought about by friction and the accompanying structural changes, has a considerable influence on the wear-resistance of metals and can even overshadow the influence of the original mechanical properties.
There are 4 figures, 1 table and 14 Soviet references.

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Investigation of the Wear-resistance of Steel Heat-treated to Obtain Granular Cementite

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Physico-technical Institute of Tomsk State University)

SUBMITTED: September 5, 1959

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S/139/60/000/005/002/031
E073/E135

AUTHORS: Savitskiy, K.V., Paskal', Yu.I., and Antonova, N.N.

TITLE: On Certain Features of the Plastic Deformation of Lead and Tin during Cyclic Heat Treatment

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 5, pp 8-12 (+ 2 plates)

TEXT: The aim of the paper was to elucidate phenomena which are characteristic for thermal fatigue and the possible occurrence of plastic deformation of lead and tin during cyclic heat treatment. Specimens of 99.98% pure lead and 99.90% pure tin were cut from pressed rods. The lead specimens were rolled into 2.5 mm thick strip, whilst the tin specimens were cylindrical, 7 mm in diameter with a facet ground along the generating line. The length of the specimens was 3.5 mm. After annealing for two hours (Pb at 200 °C, Sn at 150 °C) the specimens were polished as follows. The lead specimens were polished chemically in a mixture of perhydrol and acetic acid, whilst the tin specimens were polished electrolytically in a mixture of chloric and acetic acid. In both metals the grain dimensions were between 600 microns and 1.5-2 mm. The heating was in paraffin or

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On Certain Features of the Plastic Deformation of Lead and Tin during Cyclic Heat Treatment

colophony to 200 °C (lead) and 150 °C (tin); the cooling was in acetone at +10 °C and water at 0 °C (regime I) or in liquid nitrogen (regime II) and this was followed by heating in acetone at +10 °C after the cooling in liquid nitrogen (regime III). The cooling and the heating were by simple submersion. The selected holding times were such that the entire volume of the specimen should attain the temperature of the medium. The duration of the cycle at various regimes was between 40 sec and 1 min. The surface of the polished specimen was studied on a microscope and on a microinterferometer. 35 thermal cycles according to regimes I and II and up to 300 cycles according to regime III were carried out. During further cyclic heat treatment the observations became difficult due to corrosion. Between 5 and 10 specimens were used for each regime. It was found that as a result of heat treatment characteristic features of plastic deformation (inter-granular shifts) occur in lead. In tin the role of the grain boundaries is very great; the recrystallization

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processes reduce the magnitude of temperature stresses which occur during heat treatment. Formation of grain boundary networks has been elucidated. In further experiments with cyclic heat treatment of lead containing 1.5% Sb it was found that the hardness of this alloy increases rapidly as a result of cyclic heat treatment. This is attributed to the acceleration of the process of dispersion hardening under the effect of temperature stresses.

There are 14 figures and 12 references: 5 Soviet, 1 German, and 6 English including 1 translation.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Institute of Physics and Technology at Tomsk State University imeni V.V. Kuybyshev)

Card 3/3

SUBMITTED: November 27, 1959

SAVITSKIY, K.V.; KOGAN, Yu.I.; KUDRINA, M.P.

Wear resistance of U12 steel subjected to the formation of "white" layers. Izv. vys. ucheb. zav.; fiz. no.6:35-37 '60. (MIRA 14:3)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V. V. Kuybysheva.

(Steel—Metallography)

88049

S/139/60/000/006/016/032
E073/E335

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AUTHORS: Savitskiy, K.V., Paskal', Yu.I. and Gvozdeva, T.I.

TITLE: On Thermocyclic Ageing of Duralumin

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 6, pp. 109 - 112

TEXT: It is known that in a number of alloys creep under cyclic temperature fluctuations is different from that under isothermal conditions. I.A. Oding arrived at the conclusion that the observed reduction in creep due to cyclic temperature fluctuations is associated with the formation of alternating temperature stresses and with activation of the process of ageing. V.S. Yermakov (Ref. 2) has studied the influence of cyclic heat-treatment on the dispersion decomposition of the alloy ЭИ-437 (EI-437). He found that cyclic heat-treatment accelerates the thermocyclic ageing of the alloy. To some extent the effect of cyclic heat-treatment is analogous to the effect of an external alternating load and to the effect of ultrasonics (Ref. 3). The effect of thermocyclic ageing was also observed by the authors of this paper in lead (Ref.4).

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On Thermocyclic Ageing of Duralumin

Apparently, thermocyclic ageing is due to the effect of temperature stresses and strains caused by it and has a number of common characteristics with strain ageing. In this paper the influence of cyclic heat-treatment on the early stage of the process of ageing of duralumin Д-1 (D-1) is investigated. Wire specimens of 1 and 2 mm dia. were investigated; the microhardness was measured on 2 mm dia. specimens on which a facet about 1 mm wide was ground along the axis of the specimen. This facet was chemically polished in a mixture of nitric and phosphoric acids with water and glycerin. To prevent blackening of the ground surface as a result of quenching, the quenching was effected in acetone. The electric resistance was measured on the 1 mm specimens; most of the 1 mm dia. specimens were quenched in water. The quenching was after a 2-hour soaking at 505-510 °C. The cyclic heat-treatment was effected from -196 (liquid nitrogen) to +20 °C (water) and from -196 to +150 °C (paraffin). Heating and cooling were effected by

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On Thermocyclic Ageing of Duralumin

simple submersion. The soaking time in the heating and cooling media was selected in such a way that the entire volume of the specimen should have time to assume the temperature of the medium. The duration of the cycle was 30-35 sec. For comparison the change in the properties of identical specimens subjected to isothermal holding at +20 and +150 °C was also determined. Each experiment was repeated on 3-5 specimens; the property-treatment time curves were measured twice and good agreement was found to exist. The microhardness was measured with a ПМТ-3 (PMT-3) instrument with a 200 g load. The variance did not exceed 5% of the measured value. The electric resistance was measured by means of a bridge. The results of the treatment -196 to +20 °C and vice versa are given in Fig. 1; the properties are plotted as a function of the holding time. In Fig. 1 the changes are plotted of the microhardness (a, kg/mm^2) and of the specific electric resistance (b, μΩcm) for thermocyclic (as a function of the number of -196 °C ⇄ +20 °C cycles) ageing and isothermal

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On Thermocyclic Ageing of Duralumin

(20 °C) ageing (as a function of holding time, min.). Curves 1 and 5 represent thermocyclic ageing after quenching in acetone; Curve 2 - isothermal ageing after quenching in acetone; Curve 3 thermocyclic ageing after quenching in water; Curve 4 isothermal ageing after quenching in water. The data for the thermocyclic ageing were plotted taking into consideration the full duration of the cycle. Comparison of the thermocyclic and isothermal ageing indicates that the former accelerates the process of dispersion hardening, which is particularly pronounced during the first cycles. The hardness curve shows a pronounced maximum with a subsequent drop and passing through a minimum it shows a further slowing down of the hardness increase; the maximum microhardness is lower than that obtained in isothermal ageing of identical specimens. The electric resistance changes in a similar manner to the microhardness. Whilst in water-quenched specimens pronounced maxima and minima of the electric resistance was observed, on acetone-quenched ones these were not very pronounced. In Fig. 2, the

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results are given of comparative measurements on cyclically heat-treated (1300 cycles) and naturally-aged specimens with the same hardness. The change was investigated in the hardness of both batches during holding at +150 °C. The change in the microhardness was qualitatively the same in both cases, but the specimens which were thermocyclically aged had a higher thermal stability at 150 °C. In Fig. 2 Curve 1 relates to thermocyclically-aged specimens, Curve 2 to isothermally-aged specimens (hardness, kg/mm^2 versus duration, min). In the case of cyclic heat-treatment of -196 $\rightleftarrows$ +150 °C activation of the ageing process was observed only during the first cycles of the heat-treatment. Fig. 3 shows the changes in the microhardness (a, kg/mm^2) and in the electric resistance (b, μΩcm) as a function of the treatment time, min, and, respectively, the number of cycles for thermocyclically (-196 $\rightleftarrows$ 150 °C) and isothermally (+150 °C) aged specimens. The Curves 1 and 3 relate to thermocyclic ageing,

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Curves 2 and 4 relate to isothermal ageing.
There are 3 figures and 5 Soviet references.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Physicotechnical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: July 4, 1960

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E073/E435

On Thermocyclic Ageing of Duralumin

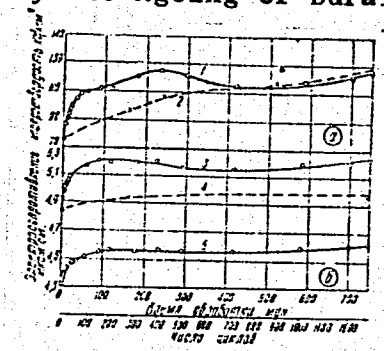

Рис. 1. Изменение микротвердости (*а*) и удельного электросопротивления (*б*) при термоциклическом (—196°С ⇄ +20°С) и изотермическом (20°С) старении. 1, 5 — термоциклическое старение после закалки в ацетоне; 2—изотермическое старение после закалки в ацетоне; 3—термоциклическое старение после закалки в воде, 4—изотермическое старение после закалки в воде.

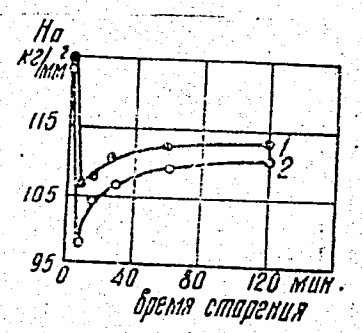

Рис. 2. Изменение микротвердости термоциклически (—196°С ⇄ +20°С) и изотермически (20°С) состаренных образцов в процессе выдержки при +150°С. 1—термоциклически состаренные образцы; 2—изотермически состаренные образцы.

Fig.2.

Card 7/8

8801s

S/139/60/000/006/016/032
E073/E435

On Thermocyclic Ageing of Duralumin

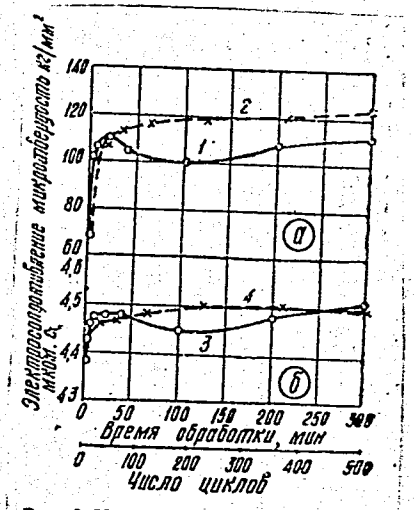

Рис. 3. Изменение микротвердости (а) и электросопротивления (б) при термоциклическом (—196°С ↔ +150°С) и изотермическом (+150°С) старении. 1, 3 — термоциклическое старение; 2, 4 — изотермическое старение.

Fig.3.

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SAVITSKIY, Konstantin Vladimirovich for Doc Phys Math Sci on the basis of dissertation defended 12 June 59 in Council of Tomsk State Univ im Kuybyshev, entitled "Study of the plastic deformations and properties of outer layers of metal bodies under various conditions of friction." (BMViSSO USSR, 1-61, 26)

18 8200 2808 26031 S/139/61/000/003/011/013
E073/E335

AUTHORS: Savitskiy, K.V. and Malyshev, Yu.F.

TITLE: Resistance to Abrasive Wear and Modulus of Elasticity of Heat-treated Brass

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1961, No.3, pp.164-166

TEXT: In earlier work of one of the authors it was shown that the increase in Rockwell hardness and other strength characteristics of brass caused by increasing the quantity of the β-phase during quenching from various temperatures had practically no influence on the resistance to abrasive wear and on the hardness determined by stretching. One of the authors (Ref.3: Izvestiya vuzov MVO SSSR, Fizika, No.2, 1958) expressed the view that evaluation of the wear-resistance of metals and alloys purely on the basis of hardness and other mechanical characteristics which were dependent on resistance to deformation did not provide an unequivocal relation between the mechanical properties and the wear resistance, and that the internal bonds between the atoms have to be taken into consideration. F. T. Barwell (Ref.4: Mashinostroyeniye, No.4, 58 1958),

Card 1/6

Resistance to Abrasive Wear ... S/139/61/000/003/011/013
E073/E335

M. M. Khrushchov and M. A. Babichev (Ref.5: DAN SSSR, 131, No.6, 1960) expressed the view that the resistance to wear showed a better correspondence with the modulus of elasticity than with the hardness measured by indentation. The latter two authors proposed the following relation between the relative resistance to wear E and the modulus of elasticity E for pure metals:

$$\varepsilon = 0.49 \times 10^{-4} E^{1.3}$$

It is stated that this relation holds for binary alloys with an unlimited series of solid solutions as well as for binary alloys with limited solubility in the eutectic and for a number of minerals. The authors of this paper believe that the correspondence between E and ε is of a more general nature than the correspondence between the relative wear resistance and the hardness measured by indentation. The here described investigations were made in order to

Card 2/6

supplement earlier investigations on the resistance-to-wear of heat-treated brass by determining the modulus of elasticity which is considered as a characteristic of the bond forces between the individual atoms. The investigations were made on 63/37 (L62) brass and for obtaining various ratios between the α- and β-phases the following heat-treatments were applied: annealing at 550 °C and quenching from 500, 550, 600, 650, 700, 750 and 800 °C. The quantity of β-phase in these was determined and their hardness was measured. Following that, specimens were produced for determining the modulus of elasticity and for abrasive-wear tests. The modulus of elasticity was determined by means of ultrasonics on specimens 1.4 x 2.9 x 14 mm, taking in each case the mean arithmetical value of 4 specimens. The abrasive-wear tests were carried out according to well-known techniques of M.M. Khrushchov and M.A. Babichev, using electrocorundum paper No. 180 as an abrasive surface. The wear was under a load of 1.2 kg at a relative speed of movement of 1.8 m/min. After covering a distance of 2.1 m, the specimen was weighed with an accuracy of 0.1 mg and each new pass was on

a fresh abrasive surface. The wear was taken as the mean arithmetical value of 6-12 successive measurements. Aluminium was used as a reference standard. The results are plotted in Fig. 1 - H_D kg/mm^2, ε, E·10^3 kg/mm^2 - all as functions of the β-phase quantity in %. It can be seen that the hardness increases with increasing percentage of the β-phase, whilst the relative wear-resistance and the modulus of elasticity remain practically unchanged. The obtained results show that the relative wear-resistance of heat-treated brass is in better qualitative agreement with the modulus of elasticity than with other mechanical characteristics of the resistance of the brass to deformation, particularly hardness. This bears out earlier results in that an increase in wear-resistance can be obtained only if the increase in hardness is combined with an increase in the bond forces of the atoms in the crystal lattice.

There are 1 figure and 9 Soviet references.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V.Kuybysheva
(Siberian Physicotechnical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: October 21, 1960

Card 5/6

26049
S/137/61/000/007/065/072
A060/A101

18.8200

AUTHOR: Savitskiy, K. V.

TITLE: On the laws of plastic deformation under friction of metals

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 7, 1961, 34-35, abstract 7Zh254 ("Tr. 3-y Vses. konferentsii po treniyu i iznosu v mashinakh. T. I." M., AN SSSR, 1960, 70-80)

TEXT: The influence of surface coefficients of friction upon the depth of propagation and the nature of the distribution of the residual deformations, the role of the heterogenization of the structure in blocking shearing strain, and also temperature stability of cold hardening and the kinetics of weakening under variation of friction schedules are considered. In the study of the influence of sliding speed, pressure and the duration of wear upon the depth of propagation and the nature of the distribution of residual deformations in the surface layer, carried out by various methods, it is established that the best results are given by metallographic methods and the coordinate network method. Experiments were carried out on technical grade Cu and Al, and carbon steel. Brake-shoe type specimens were tested at a friction of 104.4 m/min [Abstracter's note: The

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26049
S/137/61/000/007/065/072
A060/A101

On the laws of plastic deformation ...

Russian original reads 104.4 mm^2, it seems to be a misprint.] with vaseline oil lubrication on a device operating on the shaft-bearing principle. In the investigated range of sliding speeds (2.2 - 712 m/min) and values of normal loading (14 - 206 kg) the friction forces vary in a qualitative correspondence to the depth of the deformed layer. Here the increase in normal loading or sliding speed has a much stronger effect on the values of the friction forces than on the depth of the deformed layer. A qualitative relationship is established between the microhardness of the friction surface and the displacement of metal in the friction plane, as well as between the linear abrasion and the depth of propagation of residual deformations. The investigation of the influence of structural factors upon the plastic deformation of friction sufaces carried out on specimens of antifriction alloys on Al and Cu base, has confirmed the strengthening role of hard impurities at deformation of the plastic component of alloys. It is found that the heterogeneous hardening of alloys by making a network or skeleton of hard precipitates under some conditions of friction leads to a lower heat liberation and wear. It is established that sliding speed and pressure exert definite influence upon the thermal stability of deformation distortions. However, in metals with different physical properties the cold hardening of surface layers

Card 2/3

On the laws of plastic deformation ...

and its thermal stability may vary in different ways under different friction conditions. There are 15 references.

L. Gordiyenko

[Abstracter's note: Complete translation]

Card 3/3

S/123/61/000/023/001/018
A052/A101

AUTHORS: Savitskiy, K.V., Sukharina, N.N., Zagrebennikova, M.P.

TITLE: The effect of dispersion of solid inclusions on the wear resistance of two-phase alloys

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 23, 1961, 10, abstract 23A88 (V sb. "Sukhoye treniye", Riga, AN LatvSSR, 1961, 145 - 154)

TEXT: The dependence of the wear resistance of steel on the degree of dispersion of Fe_3C particles and of duralumin on the degree of dispersion of $CuAl_2$ inclusions was studied. In the process of wear of such alloys on hardened steel the plastic deformation of outside layers leads to an increased concentration of Fe_3C and $CuAl_2$ particles and to an increased hardness of friction surfaces. The degree of change of the initial structure and of mechanical properties increases with the transition to more coarse-dispersion materials. The deformation of outside layers due to friction and accompanied by a change of initial properties of alloys has a considerable effect on the wear resistance of the alloys, and can

Card 1/2

The effect of dispersion ...

even offset the effect of initial properties. The conclusion is that the initial hardness of heterogeneous alloys cannot always serve as a reliable criterion of their wear resistance.

[Abstracter's note: Complete translation]

Card 2/2

SAVITSKIY, K.V.; MALYSHEV, Yu.F.

Resistance to abrasive wear and modulus of elasticity of thermally treated brass. Izv.vys.ucheb.zav.; fiz. no.3:164-166 '61.
(MIRA 14:8)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete im. V.V.Kuybysheva.
(Brass) (Mechanical wear) (Elasticity)

S/139/61/000/004/012/023
E194/E135

AUTHORS: Savitskiy, K.V., and Zagrebennikova, M.P.

TITLE: An X-ray study of the thermal stability of the cold working of friction surfaces of copper specimens

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Fizika. no. 4, 1961. 96-101

TEXT: Plastic deformation of friction surfaces causes considerable work hardening. In previous articles the authors have studied the temperature stability of work hardening of friction surfaces of various metals, the condition of the work hardened layer being characterised by the microhardness. The results observed in the earlier work indicate that during the process of friction the substructure of the active layer of metal becomes much finer. In the present work a work hardened layer produced by sliding friction on copper specimens was examined by the X-ray method to study changes resulting from repeated annealing. The samples were copper brake blocks 20 mm long, 3 mm thick, 10 mm high, curved to a radius of 70 mm to match the steel cylinder against which they rubbed. The frictional conditions

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were those of boundary lubrication using machine oil under the following two conditions: 1) load equals 2.25 kg/mm^2 and speed equals 221 m/minute; 2) load equals 2.25 kg/mm^2 and speed equals 5.3 m/minute. For all specimens the length of the friction path was 15 km which was designed to produce sufficient wear products so that wear particles could be investigated at the same time as the surfaces. The high pressures were used to obtain a thick work-hardened layer which the X-rays would not penetrate. The thickness was found to be over 100 microns which is much greater than the layer thickness in which most of the primary beam intensity is absorbed. The wear products were particles of unoxidised copper of 10-20 microns, which, for X-ray study, were poured into a hole drilled in copper. The X-ray equipment used was type YPC-70 (URS-70) with copper radiation. Microhardness measurements were made and the microstructure of the active layer was studied. After the initial determination all the specimens were annealed in vacuum for one hour at the following temperatures in succession: 200, 250, 300, 350, 400 and 450 °C. Although the successive annealing reduced the microhardness considerably, for example, from 130 to 75, the annealed specimens were still appreciably harder

than fully annealed copper which has a microhardness of 53. Investigation of the microstructure showed that although annealing at 450 °C makes the structure coarser, the grain size is still less than half that of the initial samples before friction. The full test results are given in the three curves of Fig.2; curves 1 correspond to a sliding speed of 221 metres/min, curves 2 to 5.3 metres/min, and curves 3 to wear products. Fig.2a shows the dimensions of regions of coherent scattering $D.10^6$ cm; Fig.2b shows the microdistortion $\Delta a/a \times 10^3$; and Fig.2c shows the microhardness, kg/mm^2; all as functions of the annealing temperature. The microhardness of the wear particles could not, of course, be measured. It has been claimed that there is a relationship between the Brinell hardness and the reciprocal of the square root of the grain size, and it may be assumed that a similar relationship also holds for the microhardness. Such a relationship was indeed found. It is concluded that the main factor in strengthening the friction surface of the copper specimens is reduction in the size of the regions of coherent scattering. Although the physical and mechanical properties of frictional surfaces treated at different speeds resemble one

another very closely in respect of the changes on repeated annealing, nevertheless the entire recrystallisation curve for the friction surface run at the lower speed lies below that for the curve of higher speed. The curve of change of grain size on the friction surface as a function of the annealing temperature for the lower speed is always above that for the higher speed. Work-hardening of the wear particles is much greater than that of the friction surfaces, their grain sizes are smaller and their micro-distortion greater. G.V. Kurdyumov and L.I. Lysak are mentioned in the paper for their contributions in this field.
There are 3 figures, 2 tables and 9 Soviet-bloc references.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva
(Siberian Physico-technical Institute at Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: December 12, 1960

Card 4/4

24.7500
1.1730

30474
S/139/61/000/005/011/014
E073/E335

AUTHORS: Savitskiy, K.V. and Zagrebennikova, M.P.

TITLE: Determination of the density of dislocations at the friction surface of copper specimens

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no. 5, 1961, pp. 149 - 151

TEXT: In most annealed specimens the density of dislocations exceeds 10^6 per cm^2. Depending on the type and purity of the metal, and on the type, degree and temperature of deformation, the density of dislocations as a result of deformation increases to 10^8 - 10^{11} per cm^2. Williamson and Smallman (Ref. 1 - Russian translation published in Sbornik "Problemy sovremennoy fiziki", 9, 95, 1957) have proposed a formula based on the block dimensions D and the width of the distribution of dislocations ξ. The density of dislocations can be expressed by means of the block dimensions, using the formula:

$$\rho = 3n/D^2 \qquad (1)$$

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Determination of ....

where n is the number of dislocations at the surface of the block which have to be determined, or are given. n = 1 yields the minimum dislocation density and can be applied to annealed and to highly deformed metals, when the distribution of the dislocations is almost chaotic. Friction-working, applying a pressure of 2.25 kg/mm^2 and a speed of 121 m/min increased the microhardness of the rubbing surfaces of copper specimens to 130 kg/mm^2, as compared with 53 kg/mm^2 of the annealed copper. When the friction treatment was applied, using an equal pressure and a speed of only 5.3 m/min, the microhardness of the active surface layer reached 127 kg/mm^2. Due to the very high deformation in both cases, it is justified to use the value n = 1 in calculating the dislocation densities in the friction work-hardened layer. The block dimensions on the friction surfaces and in the wear products were determined from the width of the diffraction lines (111) and (331) and from these, the density of the dislocations ρ was calculated. The obtained data show

Determination of ....

that a change in the sliding speed by a factor of 25 has practically no influence on the magnitude of work-hardening of the copper in the thin active layer (the microhardness values being, respectively, 127 and 130 kg/mm^2). However, the dislocation densities were, respectively, 6 and 8 x 10^{-11} cm/cm^3, as compared with 25 x 10^{-11} cm/cm^3 of the wear products. The dislocation density was also calculated from the measured microhardness values in accordance with the formulae proposed by S.D. Gertsriken and N.N. Novikov - Sbornik "Issledovaniya po zharoprochnym splavam", 6, 105, 1960 (Ref. 4). The results are in agreement with those obtained from the block dimensions and, consequently, dislocations in materials can also be estimated on the basis of hardness values. Dilatometric measurements in copper deformed to a high degree by torsion showed values of 4.6 x 10^{11}. Therefore, it is concluded that in the case of friction, the rubbing surfaces accumulate dislocations many times the number which are accumulated during torsion and

Determination of ....

this explains the intensive work-hardening of rubbing surfaces. There are 2 tables and 4 Soviet-bloc references.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Physicotechnical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: June 23, 1961

Card 4/4

40982

S/659/62/009/000/016/030
I003/I203

AUTHORS Savitskiy, K. V., Zhdanova, V. N., Savitskiy, A. P. and Kulkov, V. A.

TITLE On strengthening of metals by dispersed particles

SOURCE Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam. v. 9. 1962. Materialy Nauchnoy sessi po zharoprochym splavam (1961 g.), 119–126

TEXT: The above subject has recently been widely investigated. In the present work the crystalline structure of a deformed sintered Cu-Al_2O_3 alloy was investigated by mechanical tests and by X-ray analysis. It is concluded that in the Cu-Al_2O_3 system in which the Al_2O_3 particles are practically insoluble, the mean dimensions of the blocks of the mosaic structure are smaller the higher the concentration of the strengthening phase, and the samller the dimensions of its particles. The production of heat-resistant metals with a high degree of hardness and high melting points which contain fine insoluble inclusions is very promising. In the discussion, A. Ya. Shinyayev suggested that the diffusion of such oxide inclusions in metals should be investigated, and thus throw light on the possible use of this method for the production of heat-resistant alloys. V. V. Grigor'yeva stressed that great attention should be paid to the problems discussed in the present article. There are 4 figures and 1 table

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3772h
S/139/62/000/002/023/028
E073/E535

AUTHORS: Savitskiy, K.V. and Malyshev, Yu.F.

TITLE: Influence of the structure of excess cementite on the wear-resistance of high-carbon steels

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no. 2, 1962, 155 - 157 + 2 plates

TEXT: Two batches of specimens of the high-carbon steel ...12 (U12) were tested. In the first, the excess carbide was distributed along the grain boundaries, forming a cementite network and in the second it was in the form of isolated grains in a plastic matrix. All the specimens were quenched from 750 °C and tempered at 300, 400, 500 and 660 °C, so that the matrix structure remained the same after the heat-treatment but the structure of the excess carbide differed; this enabled detecting the influence of the of the excess cementite on the wear-resistance. The abrasive wear was tested according to known methods, using electrocorundum paper with a grain size of 180 as an abrasive. The specimens were subjected to wear under a load of 1.2 kg at a velocity of 1.8 m/min. After

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Influence of the structure ....

travelling 2.1 m, the specimen was again weighed with an accuracy of 0.1 mg. The wear-resistance of steel with a cementite network was higher in every case than that of steel which contained the excess cementite in the form of isolated grains. The wear-resistance for both structures increased in direct ratio with increasing hardness of the matrix. The influence of the structure of the excess cementite did not change with changing hardness of the matrix. According to metallographic investigations, the matrix wears more intensively in both cases. Experiments on the specimens tempered at 660 °C showed that with increasing load up to 1.6 kg the rate of wear of both steels increased linearly. The influence of the shape of the excess carbides on the wear-resistance is only slight at light loads but, with increasing load, the steel with isolated cementite grains wears more rapidly than the steel with the cementite network. With equal heat-treatment, the hardness of the steel with the cementite network is higher than that of steel in which the excess

Card 2/4

Influence of the structure ....

cementite is in the form of isolated grains. Metallographic investigation of the structure in the neighbourhood of an indentation with a diamond pyramid showed that the deformed volume was appreciably lower for steel with a cementite network than for steel with isolated cementite grains. Estimation of the abrasive wear from the modulus of elasticity, without taking into consideration the structural distribution of the phases in the alloy, will yield results which may not agree with experiment. Differences in the structural distribution of the carbides also affect the wear during purely metallic friction; specimens with cementite networks showed slightly higher wear than specimens with excess cementite in the form of isolated grains. Deformation of the surface layers increased with increasing tempering temperature, whereby the surface layers deformed more intensively and more deeply in steels with granular distribution of the excess cementite. The rubbing surfaces of quenched specimens showed small islands of oxide films. However, the number of oxide-film spots in tempered specimens was considerably higher and the thickness

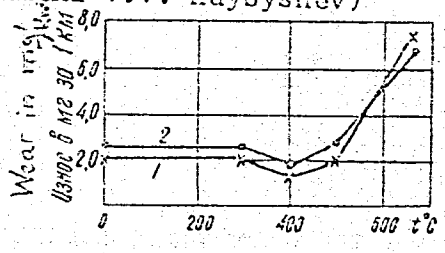
Card 3/4

of these films increased with increasing tempering temperatures. Breaking-up of the oxide films and more intensive seizing was observed at tempering temperatures of 660 °C. Fig. 7 shows the dependence of the rate of wear (mg per 1 km) as a function of the tempering temperature for steel with the excess cementite in the form of isolated grains (curve 1) and for steel with the excess cementite in the form of a network.
There are 7 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitet imeni V.V. Kuybysheva (Siberian Physicotechnical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: November 17, 1961

Fig. 7:



S/139/62/000/003/020/021
E039/E435

AUTHORS: Savitskiy, K.V., Malyshev, Yu.F.

TITLE: Investigation of the influence of the mechanical properties of heat treated brass in a strongly hardened condition on metallic wear

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Fizika, no.3, 1962, 173-174

TEXT: The ratio of the α and β phases in Л62 (L62) brass was changed by the following heat treatment: annealing at 550°C followed by tempering at 500, 550, 600, 650, 700, 750 and 800°C and measuring the hardness. Samples (1.4 x 2.9 x 14 mm) were cut from the billet and the modulus of elasticity measured by an ultrasonic method. Wear measurements were made on cylindrical (diameter 2 mm) specimens and wear was produced by hardened discs of У8 (U8) steel moving with a velocity of 0.56 m/sec relative to the sample under a load of 2.475 kg. Before the test the discs and samples were carefully polished and degreased with acetone. After the passage of the sample through a distance of 16.92 m the linear wear was measured with an accuracy of 0.005 mm, the mean of wear

on three samples being used to obtain a single point. The results, presented graphically, show that hardness increases with increase in the β phase while the metallic wear and modulus of elasticity remain unchanged. There is 1 figure.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V.Kuybysheva
(Siberian Physicotechnical Institute at Tomsk State University imeni V.V.Kuybyshev)

SUBMITTED: December 25, 1961

SAVITSKIY, K.V.; KOGAN, Yu.I.

Deformation of supercooled austenite of carbon steel caused by friction. Tren.i izn.mash. no.15:211-226 '62. (MIRA 15:4)
(Austenite--Testing)

S/126/63/015/001/023/029
E073/E151

AUTHORS: Kuznetsov, V.D., Savitskiy, K.V., and Sukharina, N.N.

TITLE: Some features of the structure of white layers

PERIODICAL: Fizika metallov i metallovedeniye, v.15, no.1, 1963, 145-148

TEXT: Friction tests on low-carbon steel (0.09-0.18% C) constantly lubricated with machine oil, gave white surface layers of high microhardness (1000-1300 kg/mm^2), which were blackened by alkaline sodium picrate and retained their hardness up to 800 °C, being removed only after annealing at 850 °C. Specimens with white layers were annealed in vacuo at 300-850 °C either in steps at 100 °C intervals, or at one temperature only. At low temperatures the polished sections showed no etching of the white layer in nitric acid but the layer showed individual spots with fine dark inclusions. After annealing above 400 °C the dark spots increased and could be observed on the unetched specimens at low magnification, and after annealing at 700-800 °C the surface layer was still hard (660-980 kg/mm^2) and would not etch, but regions formed which appeared to be covered with dark spots, particularly where the hardness was greatest. At 800 °C the white layer

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decomposed, but the pearlite formed represented a higher carbon content than the original steel; some graphite was observed, and at 650 °C decomposition into pearlite and graphite was complete, with a ferritic zone surrounding the original white layer. The amount of graphite observed was small, possibly due to diffusion during annealing. The behaviour of the non-etching white layer may be explained by the fact that the hardness of un-annealed white layers with graphite inclusions was 800-900 kg/mm^2, i.e. very much less than continuous white layers, which were 1000-1300 kg/mm^2. Differences in results obtained by other workers on the effect of the white layer on wear resistance may be due to differences in the mode of origin of the white layers, resulting in carbides of differing thermal stability. Friction in low-carbon steels may cause the formation of carbides which partially decompose to form graphite. There are 3 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy nauchno-issledovatel'skiy institut (Siberian Physico-technical Scientific Research Institute)

SUBMITTED: June 12, 1962

S/139/62/000/006/010/032
E073/E335

AUTHORS: Savitskiy, K.V., Zhdanova, V.N., Savitskiy, A.P., Kulikov, V.A. and Maslovskaya, T.I.

TITLE: The relationship between the mechanical properties and the porosity of copper produced from powder

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no. 6, 1962, 57 - 63

TEXT: The hardness and the compression strength in the as-sintered state and after deformation of 10, 20, 30% (for compression strength) and 50% (for hardness) were determined on cylindrical samples of 1-6% porosity, 12-15 mm high, 7 mm in diameter, prepared from powder passed through a sieve with a 50-μ mesh. The hardness-porosity and compressive strength-porosity curves pass through maxima for about 2.4% porosity and both the hardness and compressive strength were the higher the higher the degree of deformation. The hardness of all the samples was equal to or greater than that of cast copper, which could be explained by the existence of fine micropores formed as a result of powder-metallurgical proparation. X-ray diffraction photographs

Card 1/2

The relationship between ....

(breadth of the (331) line) showed that the block structure of copper produced from powder was finer than that of cast copper and this could influence the strength by blocking dislocations and forming a fine mosaic structure. The degree of distortion of the internal structure was estimated from X-ray diffraction photographs. The recrystallization temperature of a metal with an inertia porosity of 2.4% and deformed by 20% was 600 °C; the recrystallization temperature decreases with increasing porosity and forged copper produced from powder as the lowest recrystallization temperature, which may even be lower than that of cast copper. Double pressing with intermediate annealing and subsequent sintering at a moderately high temperature yields material of a higher strength than single pressing followed by long-duration sintering at elevated temperatures. There are 4 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V.V. Kuybysheva (Siberian Physicotechnical Institute of Tomsk State University imeni V.V. Kuybyshev)

SUBMITTED: November 21, 1961

Card 2/2

S/126/63/015/001/023/029
E073/E151

AUTHORS: Kuznetsov, V.D., Savitskiy, K.V., and Sukharina, N.N.

TITLE: Some features of the structure of white layers

PERIODICAL: Fizika metallov i metallovedeniye, v.15, no.1, 1963, 145-148

TEXT: Friction tests on low-carbon steel (0.09-0.18% C) constantly lubricated with machine oil, gave white surface layers of high microhardness (1000-1300 kg/mm^2), which were blackened by alkaline sodium picrate and retained their hardness up to 800 °C, being removed only after annealing at 850 °C. Specimens with white layers were annealed in vacuo at 300-850 °C either in steps at 100 °C intervals, or at one temperature only. At low temperatures the polished sections showed no etching of the white layer in nitric acid but the layer showed individual spots with fine dark inclusions. After annealing above 400 °C the dark spots increased and could be observed on the unetched specimens at low magnification, and after annealing at 700-800 °C the surface layer was still hard (660-980 kg/mm^2) and would not etch, but regions formed which appeared to be covered with dark spots, particularly where the hardness was greatest. At 800 °C the white layer

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decomposed, but the pearlite formed represented a higher carbon content than the original steel; some graphite was observed, and at 650 °C decomposition into pearlite and graphite was complete, with a ferritic zone surrounding the original white layer. The amount of graphite observed was small, possibly due to diffusion during annealing. The behaviour of the non-etching white layer may be explained by the fact that the hardness of un-annealed white layers with graphite inclusions was 800-900 kg/mm^2, i.e. very much less than continuous white layers, which were 1000-1300 kg/mm^2. Differences in results obtained by other workers on the effect of the white layer on wear resistance may be due to differences in the mode of origin of the white layers, resulting in carbides of differing thermal stability. Friction in low-carbon steels may cause the formation of carbides which partially decompose to form graphite. There are 3 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy nauchno-issledovatel'skiy institut (Siberian Physico-technical Scientific Research Institute)

SUBMITTED: June 12, 1962

SAVITSKIY, K.V.; SUKHARINA, N.N.

How rubbing between steels leads to the formation of a "white" layer. Izv. vys. ucheb. zav.; fiz. no.5:170-173 '62. (MIRA 15:12)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybyysheva.
(Steel)
(Friction)

SAVITSKIY, K. V.; MALYSHEV, Yu. F.

Effect of the mechanical properties of thermally treated brass on wear by friction against other metals under conditions of strong cohesion of the metals involved. Izv. vys. uch. zav.; fiz. 3:173-174 '62. (MIRA 15:10)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni V. V. Kuybysheva.

(Brass—Metallurgy) (Mechanical wear)

SAVITSKIY, K. V.; ZHDANOVA, V. N.; SAVITSKIY, A. P.; KULIKOV, V. A.; MASLOVSKAYA, T. I.

Mechanical properties of powdered copper as dependent on its porosity. Izv. vys. ucheb. zav.; fiz. no.6:57-63 '62. (MIRA 16:1)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

(Powder metallurgy) (Copper)

SAVITSKIY, K.V.; PASKAL', Yu.I.

Investigating grain growth during the process of the cyclic heat treatment of tin. Issl.po zhropr.splav. 8:214-217 '62.
(MIRA 16:6)

(Crystals--Growth) (Tin--heat treatment)

KUZNETSOV, V.D.; SAVITSKIY, K.V.; SUKHARINA, N.N.

Some characteristics of the structure of chilling layers. Fiz. met.i metalloved. 15 no.1:145-148 a '63. (MIRA 16:2)

1. Sibirskiy fiziko-tekhnicheskiy nauchno-issledovatel'skiy institut.
(Steel—Metallography) (Surface hardenin)

SAVITSKIY, K.V., doktor fiz.-matem.nauk, prof.; ILYUSHCHENKOV, M.A.; BYKONYA, A.F.; BURNAKOV, K.K.

Investigation of the abrasive capacity of grinding wheels with a ceramic binder. Vest.mashinostr. 43 no.5:60-62 My '63. (MIRA 16:5)

(Grinding wheels--Testing)

SAVITSKIY, K.V.; MALYSHEV, Yu.F.

Effect of solid dispersive inclusions, chemically unrelated to the matrix, on the durability of powdered metals. Izv.vys.ucheb.zav.;fiz. 3:37-40 '63. (MIRA 16:12)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

SAVITSKIY, K.V.; KOGAN, Yu.I.; KUDRINA, M.P.

Effect of white films on the durability of steel. Izv. vys. ucheb. zav.; fiz. no.6:158-161 '63. (MIRA 17:2)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

SAVITSKIY, K.V.; KOGAN, Yu.I.; KUDRINA, M.P.

Noncorrodibility of "white layers." Izv.vys.ucheb.zav.; fiz. no. 2:177-178 '64. (MIRA 17:6)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

SAVITSKIY, K.V.; KHLUDKOVA, A.N.

Effect of thermocyclic treatment on the mechanical properties of aluminum. Izv. vys. ucheb. zav.; fiz. no. 3:158-160 '64.
(MIRA 17:9)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

L 11971-65 EWT(m)/EPR/EWP(k)/EWP(e)/EWP(t)/EWP(b) Pf-4/Ps-4 SSD/AFETR/ASD(m)-3/AFWL/BSD JD

ACCESSION NR: AP4047346 S/0139/64/000/005/0034/0037

AUTHORS: Savitskiy, A. P.; Kozlov, Yu. I.; Itin, V. I.; Savitskiy, K. V.; Zhdanova, V. N.

TITLE: Effect of porosity on the mechanical properties of metal-ceramic copper and a Cu-Al alloy

SOURCE: IVUZ. Fizika, no. 5, 1964, 34-37

TOPIC TAGS: copper alloy, copper, metal ceramic material, porosity, mechanical property, hardness, powder metallurgy

ABSTRACT: In view of the lack of experimental data on the effect of low porosity on the mechanical properties, the authors investigated the dependence of the hardness and resistance to compression of copper and of Cu-Al alloy, prepared by powder-metallurgy methods, on the porosity. The preparation of the metal-ceramic samples is the same as described by A. P. Savitskiy et al (Poroshkovaya metallurgiya

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L 11971-65
ACCESSION NR: AP4047346

[Powder Metallurgy], in press). The copper samples were sintered at 250, 400, 550, 700, and 850°, while the Cu-Al alloy (10 atomic percent) were sintered at 500° with subsequent hot pressing at the same temperature. The porosity ranged between 0.3 and 15%. The results indicate that although the mechanical properties of a material with low porosity can exceed the corresponding properties of the cast material, owing to certain features of the structure, the dependence of these properties on the porosity remains linear, as established in earlier research. Orig. art. has: 3 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete im. V. V. Kuyby*sheva (Siberian Physicotechnical Institute at the Tomsk State University)

SUBMITTED: 26Feb64 ENCL: 00

SUB CODE: SS, MM NR REF SOV: 008 OTHER: 004

Card 2/2

KUZNETSOV, V.D. [deceased]; SAVITSKIY, K.V.; KOGAN, Yu.I.; KUDRINA, M.P.

Thermal recovery of ghost lines. Izv. vys. ucheb. zav.; chern. met. 7 no.8:129-134 '64. (MIRA 17:9)

1. Sibirskiy fiziko-tekhnicheskiy nauchno-issledovatel'skiy institut.

SAVITSKIY, K.V.; KOGAN, Yu.I.; KUDRINA, M.P.

Causes of the inability of chilled layers to undergo etching.
Fiz. met. i metalloved. 17 no.4:541-546 Ap '64.
(MIRA 17:8)

1. Sibirskiy fiziko-tekhnicheskiy institut.

PASKAL', Yu.I.; SAVITSKIY, K.V.

Some characteristics of the kinetics of natural aging of D1 Duralumin. Izv. vys. ucheb. zav.; fiz. 8 no.1:170-174 '65. (MIRA 18:3)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni akademika Kuznetsova.

ILYUSHCHENKOV, M.A.; SAVITSKIY, K.V.; KASHCHEYEV, V.N.

Increasing the abrasive capacity of the corundum and carborundum grain by vacuum thermal treatment. Izv. vys. ucheb. zav.; fiz. 8 no.1:178-179 '65. (MIRA 18:3)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni akademika Kuznetsova.

L 31856-65 EWP(e)/EWT(m)/EWA(d)/T/EWP(t)/EWP(k)/EWP(b) Pf-4 IJP(c) JD/HW

ACCESSION NR: AP5004272 S/0126/65/019/001/0117/0122

AUTHOR: Savitskiy, K. V.; Itin, V. I.; Kozlov, Yu. I.; Kulikov, V. A.

TITLE: The effect of annealing on the properties of cold-worked Cu-Al alloys prepared by the sintering method

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 1, 1965, 117-122

TOPIC TAGS: annealing, cold working, aluminum bronze, powder metallurgy, powder bronze, cast bronze, solid solution, microsegregation, sintering, diffusion annealing, copper alloy

ABSTRACT: A study has been made of the effect of annealing, following cold-working, on the mechanical properties of aluminum bronze prepared by the sintering method. The authors found that the presence of a solid solution with a changing concentration and a very fine grain in the mentioned alloy serves to improve the hardening effect during annealing. Inasmuch as a copper-aluminum alloy produced by the powder metallurgy method contains solid solution concentrations, even a small aluminum content will also enhance the hardening effect in the course of annealing. There is a basis for the belief that the production of powder bronze by the rolling method will considerably improve the mechanical properties of the

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L 31856-65

ACCESSION NR: AP5004272

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alloy when hardened by annealing. The annealing of deformed alloys produced by the powder metallurgy method improves the hardening process in the case of small as well as large aluminum concentrations. This is due to the occurrence of micro-segregation and the formation of Suzuki atmospheres in the lattice defects. "The authors are sincerely grateful to V.Ye. Papin, Yu. I. Paskal' and Yu. I. Kogan for the discussion of a number of problems and for their valuable comments." Orig. art. has: 6 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut (Siberian physicotechnical institute)

SUBMITTED: 01Nov63 ENCL: 00 SUB CODE: MM

NO REF SOV: 009 OTHER: 009

Card 2/2

L 29938-65 EWT(m)/EWP(b)/T/EWA(d)/EWP(w)/EWP(t) IJP(c) JD

ACCESSION NR: AP5004273 S/0126/65/019/001/0135/0137

AUTHOR: Savitskiy, K. V.; Gribanov, S. A.

TITLE: Effect of purity on the susceptibility of material to crack formation under the effect of cyclic heat treatment

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 1, 1965, 135-137

TOPIC TAGS: zinc, zinc heat treatment, cyclic heat treatment, crack formation, impurity effect

ABSTRACT: The effect of purity on the susceptibility of high-purity 99.95% and low-purity 98.70% (Ts3) zinc to crack formation has been investigated. Two cycles were used: "cold" cycle — 20C to -185C, and "hot" cycle — 20C to 200C. In the cold cycle the low-purity zinc was less susecptible to cracking and less sensitive to the change in cooling rate than high-purity zinc. In the hot cycle, on the contrary, high-purity zinc showed a lower susceptibility to cracking but a higher sensitivity to the change of cooling rate. In low-purity zinc, fine-grained specimens were less susceptible to cracking than coarse-grained. Prestrain (3% elongation) lowered the cracking susceptibility of high-purity zinc but increased the susceptibility of low-purity zinc. Orig. art. has: 3 figures. [WW]

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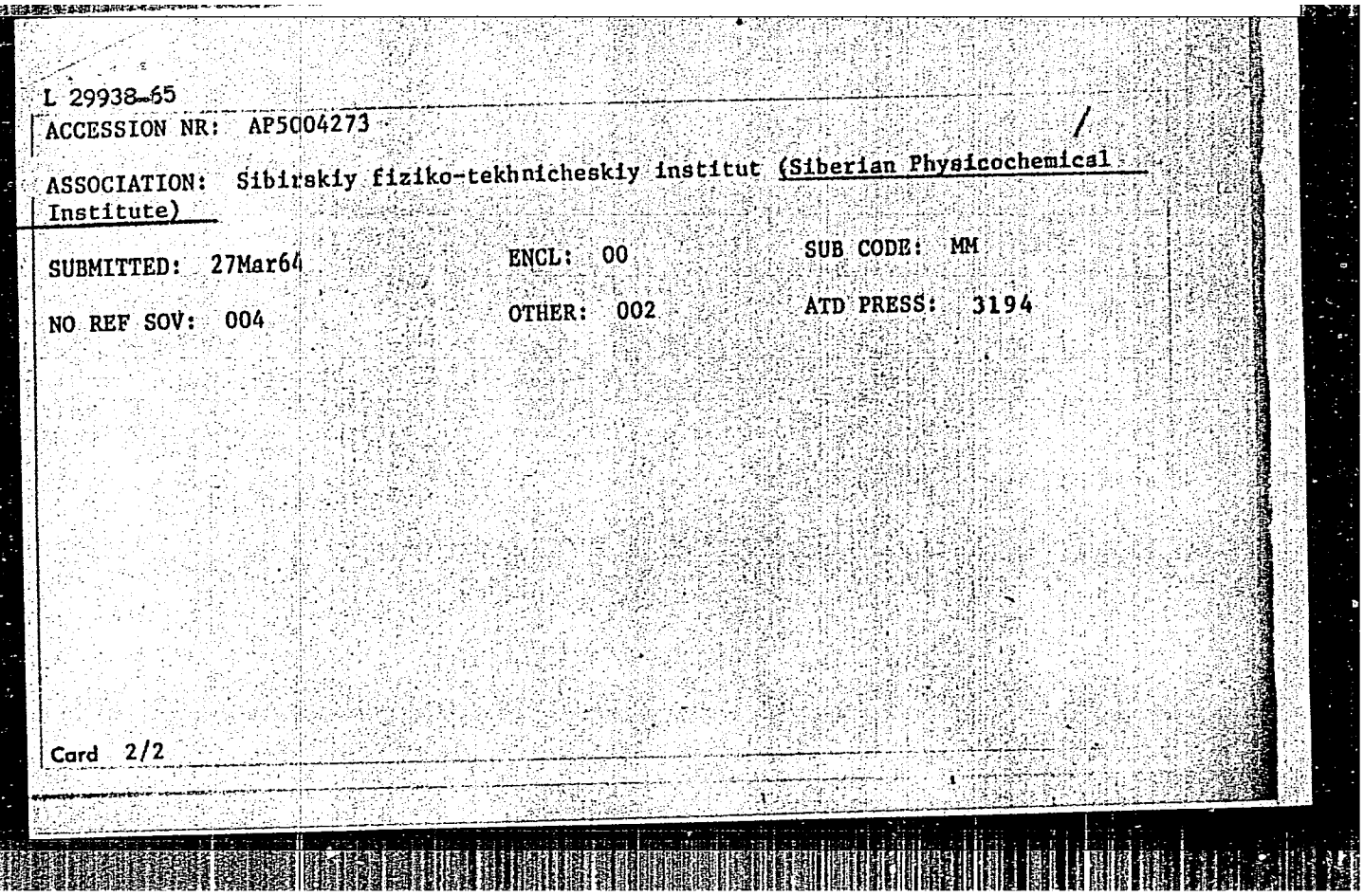

L 29938-65

ACCESSION NR: AP5004273

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut (Siberian Physicochemical Institute)

SUBMITTED: 27Mar64 ENCL: 00 SUB CODE: MM

NO REF SOV: 004 OTHER: 002 ATD PRESS: 3194

Card 2/2

ITIN, V.I.; SAVITSKIY, A.P.; SAVITSKIY, K.V.; KOZLOV, Yu.I.; KULIKOV, V.A.

Sintering of the metal ceramic alloy Cu - Al. Izv. vys. ucheb. zav.; fiz. 8 no.2:139-144 '65. (MIRA 18:7)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni Kuznetsova.

L 39729-65 EWP(e)/EWT(m)/EWA(d)/EPR/EWP(t)/EWP(k)/EWP(z)/EWP(b) Pf-4/Ps-4
ACCESSION NR: AP5006195 IJP(c) JD S/0226/65/000/002/0078/0082

AUTHOR: Savitskiy, K. V.; Kulikov, V. A.; Itin, V. I.; Kozlov, Yu. I.; Savitskiy, A. P.

TITLE: The effect of temperature on the mechanical properties of metal-powder alloys of copper with aluminum

SOURCE: Poroshkovaya metallurgiya, no. 2, 1965, 78-82

TOPIC TAGS: aluminum alloy, metallurgical research, bronze, compression strength, annealing

ABSTRACT: Because of their excellent mechanical properties, aluminum bronzes are replacing the more expensive tin bronzes. However, the poor casting properties of aluminum bronzes impede their use somewhat. These difficulties may be overcome by substituting powder metallurgy for casting. The authors examine the properties of aluminum bronzes produced by this method. Metal powder alloys with 5, 10 and 15 at. % aluminum are studied. In preparing the alloys, copper and aluminum powders with particles smaller than 50 μ were mixed for 50-70 hours.

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ACCESSION NR: AP5006195

Cylindrical specimens 7 mm in diameter and 14-15 mm high were pressed from this mixture at a pressure of 50 KN/cm^2 . After preliminary annealing in a vacuum, the specimens were pressed for a second time at a pressure of 130 KN/cm^2 and finally sintered in a vacuum of $1.5 \cdot 10^{-3}$. The intermediate annealing temperature for all materials was 700°C, the final sintering temperature: Cu--700°, Cu + 5 at. % Al--850°, Cu +10 at. % Al 850°, Cu+15% Al--950-1000°. The sintered samples were cut off on a lathe to an identical height--11±0.02 mm and then were annealed at a temperature of 700° for 1 hour to remove the cold hardening. These samples were compression tested on an R-5 machine in a temperature range from 20 to 500°C. It is found that Cu-Al alloys produced by the powder metallurgy method have a higher resistance to compression in the temperature range from 20/to 300°C than the cast alloys of corresponding composition. This phenomenon is connected with the presence of oxides in alloys, the extremely fine grain and high inhomogeneity concentration. Homogenization of the powder metal bronzes leads to improvement of the mechanical properties of the alloys at high temperatures in comparison with the non-homogenized bronzes. Hardening of the Cu-Al powder metal alloys during annealing after cold deformation by compression has a number of special features in comparison with cast alloys, in particular such hardening is stable over a wider range of temperatures and is observed at lower

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L 39729-65

ACCESSION NR: AP5006195

aluminum concentrations. Orig. art. has: 5 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy nauchno-issledovatel'skiy institut (Siberian Physicotechnical Scientific Research Institute)

SUBMITTED: 13Jun63 ENCL: 00 SUB CODE: MM

NO REF SOV: 013 OTHER: 006

Card 3/3

L 2099-66 EWP(e)/EWT(m)/T/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c) IJP(c) JD/RM
ACCESSION NR: AP5022547 UR/0226/65/000/009/0081/0090

AUTHOR: Grigor'yeva, V. V.; Savitskiy, K. V.; Zhdanova, V. N.; Kulikov, V. A.; Sergeyenkova, V. M.; Savitskiy, A. P.; Itin, V. I.; Kozlov, Yu. I.

TITLE: Resistance to deformation and stability of deformation-induced distortions of sintered powder alloys

SOURCE: Poroshkovaya metallurgiya, no. 9, 1965, 81-90

TOPIC TAGS: sintered nickel alloy, aluminum oxide containing alloy, dispersion strengthened alloy, alloy deformation resistance, deformation induced distortion, distortion stability, alloy microhardness

ABSTRACT: Compacts of powders of pure nickel and nickel with 1, 3, and 5% of α-Al_2O_3 or γ-Al_2O_3 were sintered at 1200—1400C in a hydrogen atmosphere and tested for compressive strength under compression at a rate of 0.15 mm/min with a reduction of up to 30% at 20 and 500C. The stability of deformation-induced distortions was investigated by measurements of the microhardness of specimens vacuum annealed in the 200—1050C range. The room-temperature compressive strength of sintered nickel alloys with up to 5% Al_2O_3 was slightly higher than that of pure sintered nickel, and the difference was somewhat greater at 500C. At both test temperatures,

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ACCESSION NR: AP5022547

the compressive strength was higher in alloys containing α-Al_2O_3 and slightly increased in all alloys as the Al_2O_3 concentration increased. The size of Al_2O_3 particles had practically no effect on the room-temperature compressive strength, but at 500C the compressive strength of alloys increased appreciably as the particle size of Al_2O_3 decreased from 2 to 1 μ. The type of Al_2O_3 modification had the most sharply pronounced effect on the compressive strength. For example, an alloy with 3% α-Al_2O_3 had a compressive strength of about 65 and 36 dan/mm^2 at 20 and 500C, respectively, compared with 58 and 28 dan/mm^2, respectively, for an alloy with 3% γ-Al_2O_3. Low-temperature annealing (at up to 300—400C) produced an equally slight increase in the hardness of both nickel and Ni-Al_2O_3 alloys deformed 30% at 20C. Annealing at temperatures higher than 400C decreased the hardness of sintered nickel and all Ni-Al_2O_3 alloys. However, the hardness of cold-deformed Ni-Al_2O_3 alloys after high-temperature annealing remained higher than that of identically treated sintered nickel. The hardness level of Ni-Al_2O_3 alloys increased with higher content and fineness of Al_2O_3 powder. The maximum softening of Ni and Ni-γ Al_2O_3 alloys occurred at the same temperature, while the temperature of maximum softening of Ni-α Al_2O_3 alloys was about 100C higher. The higher temperature stability of the deformation-induced distortions and a higher compressive

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ACCESSION NR: AP5022547

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strength at room and elevated temperatures favor the use of sintered Ni-α Al_2O_3 alloys. Orig. art. has: 8 figures and 5 formulas. [MS]

ASSOCIATION: Institut problem materialovedeniya AN UkrSSR (Institute of Problems of the Science of Materials, AN UkrSSR); Sibirskiy fiziko-tekhnicheskiy institut im. V. D. Kuznetsova (Siberian Physicotechnical Institute)

SUBMITTED: 02Feb65 ENCL: 00 SUB CODE: MM

NO REF SOV: 006 OTHER: 014 ATD PRESS: 4113

Card 3/3

L 2710-66 EWT(m)/EWP(e)/EWP(w)/T/EWP(k)/EWP(z)/EWP(b)/EWP(t) IJP(c) JD/EM

ACCESSION NR: AP5017182 UR/0139/65/000/003/0124/0128

41
39
B

AUTHOR: Itin, V. I.; Savitskiy, A. P.; Kozlov, Yu. I., Savitskiy, K. V.

TITLE: Influence of the sintering temperature on the mechanical properties of Cu-Al alloy prepared by the method of multiple pressing and sintering

SOURCE: IVUZ. Fizika, no. 3, 1965, 124-128

TOPIC TAGS: copper alloy, aluminum containing alloy, powder metal compaction, powder metal sintering, temperature dependence

ABSTRACT: This is a continuation of earlier work by the authors (Izv. Vuzov SSSR, Fizika, No. 2, 139, 1965) and is aimed at eliminating the pores which appear in Cu-Al alloys sintered at temperatures above the eutectic melting point. To eliminate these defects the authors propose a two-step technology, wherein the pores are eliminated by a second pressing and sintering. The dependence of the hardness and resistance to compression of an alloy of copper with 10 at.% aluminum on the temperature of the sintering was measured at temperature 300, 400, 500, 600, 700, 900, and 1040C. The preparation of the samples and the test procedures are described. The maximum resistance to compression and maximum hardness was obtained at 500C, while best ductility was obtained at 600--700C. The results are analyzed from the point of view of formation of new phases of solid solutions at various

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ACCESSION NR: AP5017182

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temperatures. It is concluded that optimal mechanical properties are obtained by multiple pressing and sintering at 600--700C. The second pressing with subsequent sintering seals the pores and at the same time reduces the number of stress concentrators in the sintered alloy. Variation of the second-sintering temperature and of the pressure permits variation of the grain size and the degree of homogeneity, thus yielding alloys with prescribed properties. Orig. art. has: 5 figures.

ASSOCIATION: Sibirskiy fiziko-tekhnicheskiy institut imeni V. D. Kuznetsova (Siberian Physicotechnical Institute)

SUBMITTED: 12Dec63 ENCL: 00 SUB CODE: MM

NR REF SOV: 005 OTHER: 001

Card 2/2

L 8910-66 EWP(e)/EWT(m)/ETC/EWG(m)/T/EWP(t)/ÆWP(b) IJP(c) JD/JG/AT/WH

ACC NR: AP5027595 UR/0145/65/000/009/0137/0142

AUTHOR: Savitskiy, K. V. (Doctor of Physico-mathematical Sciences, Professor); Ilyushchenkov, M. A. (Aspirant); Kargopolova, T. D. (Aspirant); Bykonya, A. F. (Aspirant)

ORG: Siberian Technico-Physical Institute (Sibirskiy fiziko-tekhnicheskiy institut)

TITLE: Vacuum heat treatment of high-melting, high-hardness chemical compounds. 1. Silicon carbide

SOURCE: IVUZ. Mashinostroyeniye, no. 9, 1965, 137-142

TOPIC TAGS: heat treatment, silicon carbide, crystal property, CRYSTALLOGRAPHY, SOLID MECHANICAL PROPERTY

ABSTRACT: The article examines the effect of temperature and of the duration of vacuum annealing on the strength properties of technical grade silicon carbide. Crystals of black silicon carbide with a particle size of 1 and 2 mm were prepared. The shear fracture strength of the 2 mm particles was tested on a TsDm press at a loading rate of 6 mm min. Crystals of both sizes were tested for microhardness. The vacuum heat treatment was done in a special vacuum chamber which could sustain a temperature of 1200°C for an

UDC: 546.281

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ACC NR: AP5027595

indefinite time at a vacuum of not less than 10^{-3} mm Hg. The crystals were treated for 5, 10, 20, 50 and 100 hours at 1200°C. At the end of the treatment, simultaneously with determination of strength and microhardness, the weight loss was determined, and the surface of the crystals was observed photographically. Results are shown in a table and a series of figures. Results show that the shear fracture strength of crystals of black silicon crystals increases with an increase in treatment temperature. The most intensive rise in strength takes place at a treatment temperature above 900°C; after treatment at 1200°C, the crystals are approximately 20% stronger. The most intensive increase in mechanical strength of the crystals was observed for those crystals which contained the most impurities. The magnitude of this effect increases with an increase in temperature and duration of treatment. The observed loss in weight is due in part to the elimination, under vacuum, of contaminants such as calcium oxide, aluminum oxide, and free carbon, and partly to the process of decomposition of the silicon carbide into more volatile compounds such as Si, SiC_2 and Si_2C. To obtain the highest mechanical properties, there is no apparent reason to increase the duration of the treatment at 1200°C beyond 20 to 40 hours. It would be required to raise the temperature

L 8910-66

ACC NR: AP5027595

ceiling above 1200°C and to create a higher vacuum. Orig. art. has: 4 figures and 1 table.

SUB CODE: 07, 20/ SUBM DATE: 10Dec63/ ORIG REF: 007

OTH REF: 00

Card 3/3

SAVITSKIY, K.V.; ITIN, V.I.; KOZLOV, Yu.I.; SAVITSKIY, A.P.

Effect of the dispersity of an aluminum powder on the sintering of the Cu-Al alloy in the presence of the liquid phase. Porosh. met. 5 no.11:19-25 N '65. (MIRA 18:12)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni V.D.Kuznetsova. Submitted February 13, 1965.

KHLUDKOVA, A.N.; SAVITSKIY, K.V.

Effect of the quenching temperature on pore formation in cyclic thermal treatment of aluminum. Izv. vys. ucheb. zav.; fiz. 8 no.6:35-38 '65. (MIRA 19:1)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni V.D. Kuznetsova.
Submitted July 28, 1964.

PASKAL', Yu.I.; SAVITSKIY, K.V.; RAZHEV, V.P.

Some characteristics of the hardening of aluminum alloys containing copper and magnesium. Izv. vys. ucheb. zav.; fiz. 8 no.6:166-167 '65. (MIRA 19:1)

1. Sibirskiy fiziko-tekhnicheskiy institut imeni V.D. Kuznetsova.
Submitted December 30, 1964.

L 46662-66 EWP(e)/EWT(m)/T/EWP(t)/ETI/EWP(k) IJP(c) JD/WW/JG/JH

ACC NR: AP6009571 (N) SOURCE CODE: UR/0226/65/000/011/0019/0025

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B

AUTHOR: Savitskiy, K. V.; Itin, V. I.; Kozlov, Yu. I.; Savitskiy, A. P.

ORG: Siberian Physico-Technical Institute im. V. D. Kuznetsov (Sibirskiy fiziko-tekhnicheskiy institut im. V. D. Kuznetsova)

TITLE: Effect of the dispersion of aluminum powder on the sintering of Cu-Al alloy in the presence of liquid phase

SOURCE: Poroshkovaya metallurgiya, no. 11, 1965, 19-25

TOPIC TAGS: powder metal sintering, aluminum, copper, powder alloy, particle size

ABSTRACT: The sintering of pressed shapes whose components can form eutectic alloys may, owing to contact pressure, involve formation of the liquid phase at temperatures markedly below the melting point of the readily fusible component. The formation of the liquid phase in Cu-Al alloys triggers two opposite processes: shrinkage or enlargement of the pressed briquet, either one of which prevails depending on pressing and sintering conditions, as well as on the particle size of aluminum powder. To further clarify these conditions, the authors investigated a powder-metal alloy of Cu with 10 at.% Al. The samples investigated contained Al powder in

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L 46552-66

ACC NR: AP6009571

different particle sizes: <50 μ, 63-100 μ, 100-160 μ, 250-315 μ, and 400-630 μ, mixed with Cu powder (particle size <50 μ). These mixtures were pressed into cylindrical briquets which were then vacuum-sintered. After sintering the linear and volumetric shrinkage of the briquets was determined. Findings: samples sintered at above-eutectic temperatures (>548°C) undergo enlargement in volume; the extent of this enlargement is the greater the finer the particle size of Al is and the slower the rate at which the samples are heated to the temperature of isothermal exposure. The formation of the liquid phase, as established by radiographic and metallographic analyses, is the major factor in this process: the growth in the size of the sintered briquets is chiefly associated with the formation of an alloy of copper and aluminum owing to the preferential diffusion of Al atoms from the liquid to the solid phase. If the diffusion is not complete, the briquets may undergo shrinkage instead of expansion in volume. Smaller Al particles are more advantageous, since then the area of contact between Cu and Al particles in the briquets is greater and this contributes to a more complete diffusion from the liquid to the solid phase. Orig. art. has: 6 figures.

SUB CODE: 11, 20, 13/ SUBM DATE: 13Feb65/ ORIG REF: 007/ OTH REF: 003

Card 2/2

L 31967-66 EWP(e)/EWT(m)/T/EWP(t)/ETI/EWP(k) IJP(c) JD/JH
ACC NR: AP6017096 (N) SOURCE CODE: UR/0226/66/000/001/0005/0011

AUTHOR: Savitskiy, K. V.; Itin, V. I.; Kozlov, Yu. I

ORG: Siberian Physicotechnical Institute im. V. D. Kuznetsov (Sibirskiy fiziko-tekhnicheskiy institut)

TITLE: Investigation of the mechanism of sintering powder-metal alloys of copper and aluminum in the presence of the liquid phase

SOURCE: Poroshkovaya metallurgiya, no. 1, 1966, 5—11

TOPIC TAGS: sintering, sintering temperature, eutectic, aluminum alloy, aluminum powder, copper alloy, powder alloy, powder metal, powder metal sintering

ABSTRACT: Experimental data have shown that during sintering of a mixture of aluminum and copper powders in vacuum, at temperatures exceeding the eutectic, the samples tested increased in volume. This increase was in direct proportion to the concentration of aluminum in the alloy. The increase in volume of the sintered samples is attributed to the swelling of copper particles due to the diffusion of aluminum into them and formation of cavities in place of the aluminum particles. [AM]
Orig. art. has: 5 figures.

SUB CODE: 11/ SUBM DATE: 08Apr65/ ORIG REF: 017/ OTH REF: 007

Card 1/1

L 20609-66 EWT(m)/EWP(e) WH

ACC NR: AP6010269 SOURCE CODE: UR/0145/66/000/001/0153/0157

AUTHOR: Savitskiy, K. V. (Doctor of physico-mathematical sciences; Professor); Ilyushchenkov, M. A. (Senior research associate); Burnakov, K. K. (Engineer); Muratova, L. V. (Engineer)

ORG: Siberian Institute of Engineering Physics (Sibirskiy fiziko-tekhnicheskiy institut)

TITLE: Vacuum firing of hard refractory compounds: aluminum oxide

SOURCE: IVUZ. Mashinostroyeniye, no. 1, 1966, 153-157

TOPIC TAGS: aluminum oxide, aluminum oxide firing, sapphire firing, vacuum firing

ABSTRACT: The effect of vacuum firing on the properties of four grades of aluminum oxide, OKS_1, standard electrocorundum, white electrocorundum, and sapphire, has been investigated. Vacuum firing at 600—1200C was found to increase the shear strength and microhardness and to bring about a weight loss. The magnitude of all three effects depended on the purity of aluminum oxide, and at a given purity on the firing temperature and time. For instance, firing at 1200C for 5 hr almost doubled the shear strength of standard (low-purity) electrocorundum, increased its microhardness from 1790 to 1970 kg/mm^2, and brought about a weight loss of 103.7 mg. In white (high purity) electrocorundum, the same treatment increased the shear strength by 25% and the microhardness from 2200 to 2360 kg/mm^2, and caused a weight loss of

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